InfiniHost® III Ex PCI Express x8 RoHS HCA Adapter Cards User's Manual

P/N: MHEA28-XSC, MHEA28-XTC, MHGA28-XSC, MHGA28-XTC,
MHEA28-1SC, MHEA28-1TC, MHGA28-1SC, MHGA28-1TC, MHGA28D-1TC
MHEA28-2SC, MHEA28-2TC, MHGA28-2SC, MHGA28-2TC

Rev 1.20

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InfiniHost® III Ex PCI Express x8 RoHS HCA Adapter Cards User's Manual

Document Number: 2699

Mellanox Technologies, Inc.
2900 Stender Way
Santa Clara, CA 95054
U.S.A.
www.mellanox.com

Tel: (408) 970-3400
Fax: (408) 970-3403

Mellanox Technologies Ltd
PO Box 586 Hermon Building
Yokneam 20692
Israel

Tel: +972-4-909-7200
Fax: +972-4-959-3245

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Revision History

Table 1 - Revision History Table

Date	Rev	Comments/Changes
August 2008	1.20	Removed Watermark and Confidential in the Footer
March 2008	1.13	Added MIC Statement Added MIC/BCC and C-Tick Certs for relevant cards in Appendix A Cert. Table
Feb. 2008	1.12	Added P/N MHGA28D-1TC and its specifications Added MIC Statement and Numbers and CTUVUS to Specifications
December 2006	1.11	Added EMC VCCI statements to Appendix A,“Specifications,” on page 41
November 2006	1.10	Added EMC Class A and Class B statements to Appendix A,“Specifications,” on page 41
October 2006	1.00	First release

About this Manual

This card *User's Manual* describes Mellanox Technologies InfiniHost™ III Ex PCI Express x8 RoHS-compliant HCA cards. It provides details as to the interfaces of the board, specifications, required software and firmware for operating the board, and relevant documentation.

Intended Audience

This manual is intended for the installer and user of the PCI Express x8 HCA cards listed in "Overview" on page 10.

The manual assumes basic familiarity with the InfiniBand™ architecture specification.

Related Documentation

Table 2 - Documents List

InfiniHost™ III Programmer's Reference Manual Document no. 2248PM	Reference describing the interface used by developers to write a driver for Mem-free Mellanox InfiniHost™ III devices
InfiniHost™ Programmer's Reference Manual Document no. 2111PM	Reference describing the interface used by developers to write a driver for Mellanox InfiniHost™ III devices with on-board memory (Infini-Host mode)
InfiniHost™ III Ex MT25208 Hardware Reference Manual Document no. 2246HM	Reference for hardware engineers responsible for designing systems and boards incorporating InfiniHost™ III Ex components
Mellanox Firmware Tools (MFT) User's Manual Document no. 2204UG	User's Manual describing the set of MFT firmware management tools for a single InfiniBand node. See http://www.mellanox.com under Firm-ware Downloads
InfiniBand Administration (IBADM) Package User's Manual Document no. 2130UM	User's Manual describing the utilities included in the IBADM tools package for system administration of an InfiniBand cluster. See http://www.mellanox.com under Management Tools

Online Resources

- Mellanox Technologies Web pages: http://www.mellanox.com
- Mellanox Technologies Firmware download Web page: http://www.mellanox.com/ under Firmware downloads
- Mellanox Technologies Document Distribution System (DDS): http://docs.mellanox.com (requires a customer login account)

Document Conventions

When discussing memory sizes, MB and MBytes are used in this document to mean size in mega bytes. The use of Mb (small b) indicates size in mega bits.

1 Overview

This document is a *User's Manual* for Mellanox Technologies host channel adapter (HCA) cards based on the MT25208 InfiniHost™ III Ex HCA IC device. The cards described in this manual have the following main features:

- IBTA v1.2 compliant
- Two 4X InfiniBand copper ports for connecting InfiniBand traffic (4X IB connectors)
- PCI Express expansion board with an x8 edge connector compatible to the PCI Express 1.0a specification
- 'Media detect circuit' supporting external InfiniBand fiber solutions
- EU Restriction of Hazardous Substances (RoHS) compliant

The boards differ in

- 4X IB port speed support: 10Gb/s (SDR) or 20Gb/s (DDR)
- On-board memory size: Mem-free (0MB), 128MB, 256MB or 512MB
- Bracket height: short or tall

Mem-free HCA Cards

Table 3 lists the Mem-free HCA cards described in this manual.

Table 3 - Mem-free HCA Cards

Ordering Part Number (OPN)	IB SDR / DDR	On-board Memory Size / Mem-free	Short / Tall Bracket	RoHS Compliance	HCA IC Part Number	Mem-free HCA Card Photo [a]
MHEA28-XSC	SDR	Mem-free	Short	RoHS-R5	MT25208A0-FCC	Figure 1: MHEA28-XTC
MHEA28-XTC			Tall			
MHGA28-XSC	DDR		Short	RoHS-R5	MT25208A0-FCC-D	Short Bracket (-XSC) Tall Bracket (-XTC)
MHGA28-XTC			Tall			

a. The Mem-free HCA cards have a similar form and fit. The main visible difference is in the bracket height.

HCA Cards with On-board Memory

Table 4 lists the HCA cards with on-board memory described in Part II.

Table 4 - HCA Cards with 128MB / 256MB On-board Memory

Ordering Part Number (OPN)	IB SDR / DDR	On-board Memory Size / Mem-free	Short / Tall Bracket	RoHS Compliance	HCA IC Part Number	HCA Card with On-board Memory Photo [a]
MHGA28D-1TC	DDR	128 MByte	Tall	RoHS-R5	MT25208A0-FCC-D	TBD
MHEA28-1SC	SDR		Short	RoHS-R5	MT25208A0-FCC	
MHEA28-1TC			Tall			
MHGA28-1SC	DDR		Short	RoHS-R5	MT25208A0-FCC-D	
MHGA28-1TC			Tall			
MHEA28-2SC	SDR	256 MByte	Short	RoHS-R5	MT25208A0-FCC	
MHEA28-2TC			Tall			
MHGA28-2SC	DDR		Short	RoHS-R5	MT25208A0-FCC-D	
MHGA28-2TC			Tall			

Figure 2: MHGA28-1TC

Short Bracket (-?SC)

Tall Bracket (-?TC)

a. HCA cards of the same generation have a similar form and fit. The main visible difference is the bracket height.

Mellanox HCA Cards Part Numbering Key

Table 5 describes the Mellanox Technologies HCA cards part numbering key.

Table 5 - Mellanox HCA Cards Part Numbering Key

HCA Card OPN MHTS#IG-XBR	Field	Decoder	Example: MHGA28-2TC
M	Mellanox Technologies		M
H	HCA	H=HCA Card, S= Express Card (SIOM)	H
T	Media	C=Cu SDR, E=Cu SDR + Active Cable, G=Cu DDR + Active Cable, F=Fiber SDR	E
S	HCA IC	T= InfiniHost™, A= InfiniHost™ III Ex, S= InfiniHost™ III Lx	A
#	# IB ports	1=1, 2=2, … A=10, B=11, … <limit to one character>	2
I	Interface	X=PCI-X, 4=PCIe x4, 8=PCIe x8	8
G	Generation	<blank>=Initial Generation, D=Gen. D	
-	Separator		-
X	Memory Size	X=MemFree, 1=128MB, 2=256MB, 3=512MB	2
B	Bracket	S=Short, T=Tall, N=None	T
R	RoHS	<blank> = non-RoHS, C=RoHS w/ Exemption, R=RoHS Lead-Free	C

Finding the GUID and Serial Number on the Adapter Cards

All mellanox HCA adapter cards have a label on the printed side of the adapter card that has the card serial number and the card GUID.

Figure 3: Card Product Label

HCA Card Installation

Hardware and Software Requirements

Before installing the HCA Adapter card, please make sure that the system meets the hardware and software requirements listed in Table 6, "Hardware and Software Requirements".

Table 6- Hardware and Software Requirements

Requirement	Description
Hardware	PCI Express x8 slot or x16 slot
Software Operating Systems/Distributions	• For Windows see WinIB ReadMe at https://docs.mellanox.com/dm/WinIB/ReadMe.html • For Linux see Mellanox OpenFabrics Enterprise Distribution (OFED) software package available via the Mellanox OpenFabrics Web site http://www.mellanox.com/products/ofed.php

Installation Instructions

Read all installation instructions before connecting the equipment to the power source. Please consult the host machine documentation for instructions on how to install a PCI Express card.

1.0.1 Installation Instructions as per Host Machine

The adapter cards listed in Table 5 on page 12 are standard PCI Express cards each with a standard x edge connector. Please consult the host machine documentation for instructions on how to install a PCI Express card.

Safety Warnings

1. Installation Instructions

Read all installation instructions before connecting the equipment to the power source.

2. Over-temperature

This equipment should not be operated in an area with an ambient temperature exceeding the maximum recommended:55°C (131°F). Moreover, to guarantee proper air flow, allow at least 8cm (3 inches) of clearance around the ventilation openings.

3. During Lightning - Electrical Hazard

During periods of lightning activity, do not work on the equipment or connect or disconnect cables.

4. Equipment Installation

This equipment should be installed, replaced, or serviced only by trained and qualified personnel.

5. Equipment Disposal

Disposal of this equipment should be in accordance to all national laws and regulations.

6. Local and National Electrical Codes

This equipment should be installed in compliance with local and national electrical codes.

Updating HCA Card Firmware

Each HCA card is shipped with the latest version of qualified firmware at the time of manufacturing. Firmware is updated occasionally and the most recent firmware can be obtained from http://www.mellanox.com through the 'Firmware Downloads' link. The HCA firmware download pages include the following firmware update options:

- Single HCA card firmware update
- InfiniBand cluster firmware update
- Customized firmware (.mlx,.ini) firmware update - OEMs Only

Single HCA Card Firmware Update

Firmware can be updated on the standalone single card using the **flint** tool of the *Mellanox Firmware Tools (MFT)* package. This package is available for download, along with its user's manual, from the single HCA card firmware update page. See http://www.mellanox.com under 'Firmware Downloads'.

A firmware binaries table lists a binary file per HCA card. The file name of each such binary is composed by combining the firmware name, the firmware release version, and the card part number. See Table 7.

Table 7 - Firmware Images for InfiniHost™ III Ex PCI Express HCA Cards

Type of HCA Card	PCI DevID (Decimal) & Firmware Image Name	Examples
Mem-free	PCI DevID: 25218 Firmware: fw-25218	*fw-2518-5_1_400-MHEA28-XSC.bin.zip* is the firmware binary of firmware fw-25218 version 5.1.400, for the mem-free HCA card MHEA28-XSC
With on-board memory	PCI DevID: 25208 Firmware: fw-25208	*fw-25208-4_7_600-MHGA28-1TC.bin.zip* is the firmware binary of firmware fw-25208 version 4.7.600, for the HCA card MHEA28-XSC with 128MB on-board memory

HCA Card Firmware Update as Part of a Cluster Firmware Update

If the HCA card is part of an InfiniBand cluster, its firmware can be updated as part of the entire cluster firmware update using the ***ibfwmgr*** tool of the IB administration (IBADM) tools package. IBADM is available for download as part of IB stack distributions such as IB Gold and OFED[1] available via http://www.mellanox.com. See 'Firmware Downloads' under the same webpage for cluster update instructions.

1. Currently, only the Linux distributions support updating firmware for an entire InfiniBand cluster.

Customized HCA Card Firmware Update (OEM Only)

Note: The procedure described in this section is normally *not* needed and applies to OEMs only.

To create a customized firmware binary, the firmware image in MLX format needs to be downloaded along with the *MFT* tools package. See http://www.mellanox.com under ‘Firmware Downloads’ for customized firmware update instructions.

Adapter Card Interfaces

I/O Interfaces

Each HCA card includes the following interfaces:

- Two 4X InfiniBand copper connectors
- PCI Express x8 edge connector
- I/O panel LEDs
- I^2C compatible connector (for debug)

1.0.2 InfiniBand Interface

The InfiniHost™ III Ex (MT25208) device is compliant with the *InfiniBand Architecture Specification, Release 1.2*. It has two compliant 4X InfiniBand ports, A and B, each having four Tx/Rx pairs of SERDESs. Each of the HCA cards (listed in Table 3 and Table 4) based on this device provides access to these ports by means of two 4X InfiniBand connectors for external InfiniBand copper cables also compliant with the IBTA specification 1.2. Connector 1 connects to port A of the device, while connector 2 connects to port B.

Furthermore, each of the HCA cards is embedded with a 'media detect circuit' that supports external InfiniBand fiber solutions to be connected to the InfiniBand port connectors using active media converters such as Emcore's *QTR3400 Smart Module* or Fujitsu's *FPD-010R008-0E o-microGiGaCN*.

1.0.3 PCI Express Interface

The InfiniHost™ III Ex (MT25208) device has eight Tx/Rx pairs of SERDESs providing for a PCI Express x8 interface, version 1.0a compatible. The device can be either a master initiating the PCI Express bus operations or a slave responding to PCI bus operations. The PCI Express bus can connect to either a host CPU in an HCA application or to an I/O device (such as Gigabit Ethernet) when used as a Target Channel Adapter.

1.0.4 LED Assignment

The board has four LEDs located on the I/O panel - 2 LEDs per 4X port. The physical link (green) illuminates once VAPI (InfiniBand Verbs API) is started and a physical connection is made between two nodes. The data activity link (yellow) illuminates once the InfiniBand network is discovered over the physical link. The activity link is a steady yellow when it is discovered but no data is being passed. The activity link blinks when data is being passed. If the LEDs are not active, either the physical or the logical (or both) connections have not been established. See Figure 6, "I/O Panel with Dual Ports and LEDs (Tall Bracket)," on page 22.

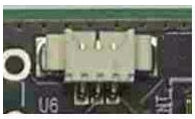
Table 8 - LEDs

Port 1	LED Name
	Physical Link - Green
	Data Activity - Yellow
Port 2	**LED Name**
	Physical Link - Green
	Data Activity - Yellow

1.0.5 I²C Compatible Interface

A three-pin header is provided as the I²C compatible interface. Table 9 provides the reference designation information of the I²C connector per HCA card type (mem-free or with on-board memory).

Table 9 - I²C Connector Reference Designation

Card Type	Reference on Board	Picture
Mem-free	J3	
With on-board memory	J1	

For the I²C connector location on mem-free HCA cards see Figure 4 on page 20.

For the I²C connector location on the HCA cards with on-board memory see Figure 5 on page 21.

Power

All adapter cards receive power from the PCI Express Edge connector. All other required power voltages are generated by on-board switch mode regulators. For power consumption see Appendix A, “Specifications” on page 41.

Memory

Each adapter card supports multiple memory devices through the DDR SDRAM[1], Flash and I²C compatible interfaces.

1.0.6 DDR SDRAM (Not Applicable to Mem-free Cards)

The board is compliant with the JEDEC standard "JESD79" Double Data Rate (DDR) SDRAM Specification, and is populated with an unbuffered, ECC protected 333 MHz memory.

1.0.7 FLASH ROM

The board supports 4MB of Flash ROM space via the CPU interface of the MT25208 InfiniHost™ III Ex device. The details of the Flash supported are:

- 8 bit data
- 22 bit address
- Programming via the CPU bus

Intel’s TE28F320J3C-110 / TE28F320J3D-110 Flash device used on the board has the following characteristics:

- 32 Mb Uniform (4MB)
- 110 ns access time

1. Not applicable to Mem-free HCA cards.

There is a jumper on each HCA card that indicates to the HCA IC whether an on-board Flash device exists (or is to be used). Table 10 provides information on this jumper per HCA card type (mem-free or with on-board memory).

Table 10 - Jumper Configuration

Card Type	Reference on Board	Name	Description	Option		Default Configuration	Comments
Mem-free	J4	FLASH	FLASH is Present/ Not Present	No Shorting Block: FLASH Present With Shorting Block: FLASH Not Present		No Shorting Block	Header 1x2
With on-board memory	J3						

For the Flash jumper location on mem-free HCA cards see Figure 4 on page 20.

For the Flash jumper location on the HCA cards with on-board memory see Figure 5 on page 21.

1.0.8 EEPROM

The board incorporates an EEPROM that is accessible through an I^2C compatible interface. The EEPROM is used for storing the Vital Product Data (VPD). VPD format adheres to the *PCI Local Bus Specification rev 2.3* VPD definition (see "Vital Product Data (VPD) Format" on page 23).

EEPROM capacity is 1KByte.

Mechanical Information

Air Flow Requirement

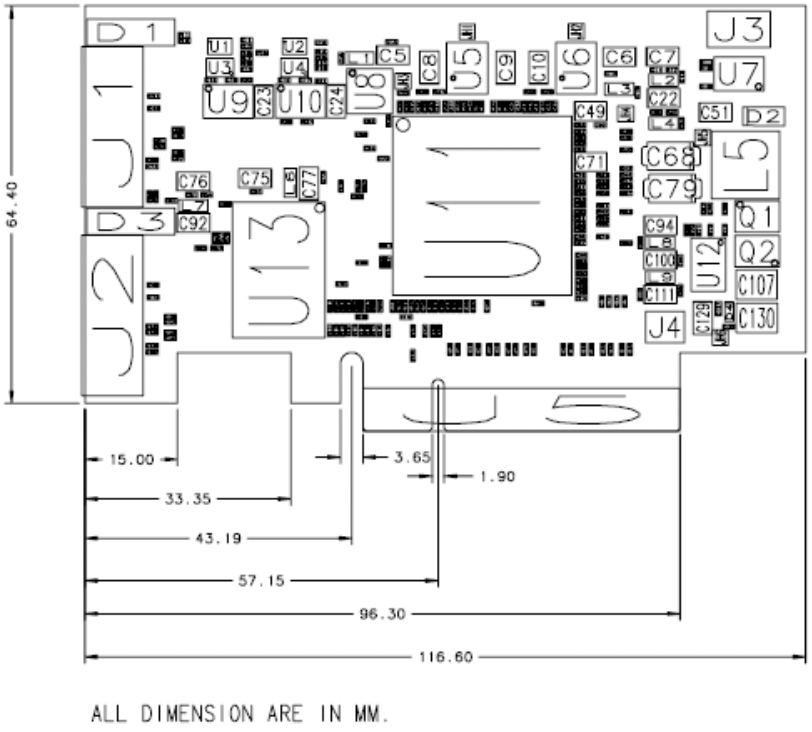
Per the PCI Express specification, all the HCA cards covered in this *User's Manual* require an airflow of 200 LFM at 55°C ambient temperature.

Board Mechanical Drawing and Dimensions

1.0.9 Mem-free HCA Cards

All the mem-free HCA cards covered in this *User's Manual* have the same mechanical drawing and share the same dimensions as depicted in Figure 4.

Figure 4: Mem-free HCA Cards Mechanical Drawing and Dimensions (mm)



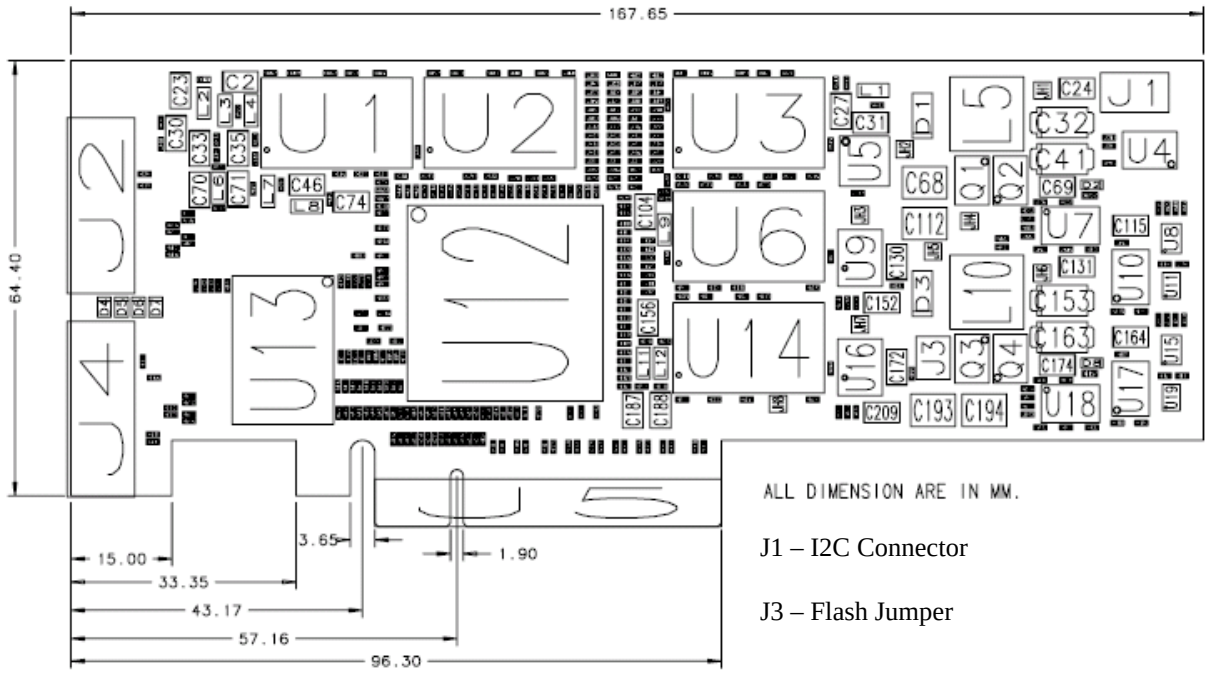
J3 – I2C Connector

J4 – Flash Jumper

1.0.10 HCA Cards with On-board Memory

All the HCA cards with on-board memory covered in this *User's Manual* have the same mechanical drawing and share the same dimensions as depicted in Figure 5.

Figure 5: HCA Cards with On-board Memory Mechanical Drawing and Dimensions (mm)

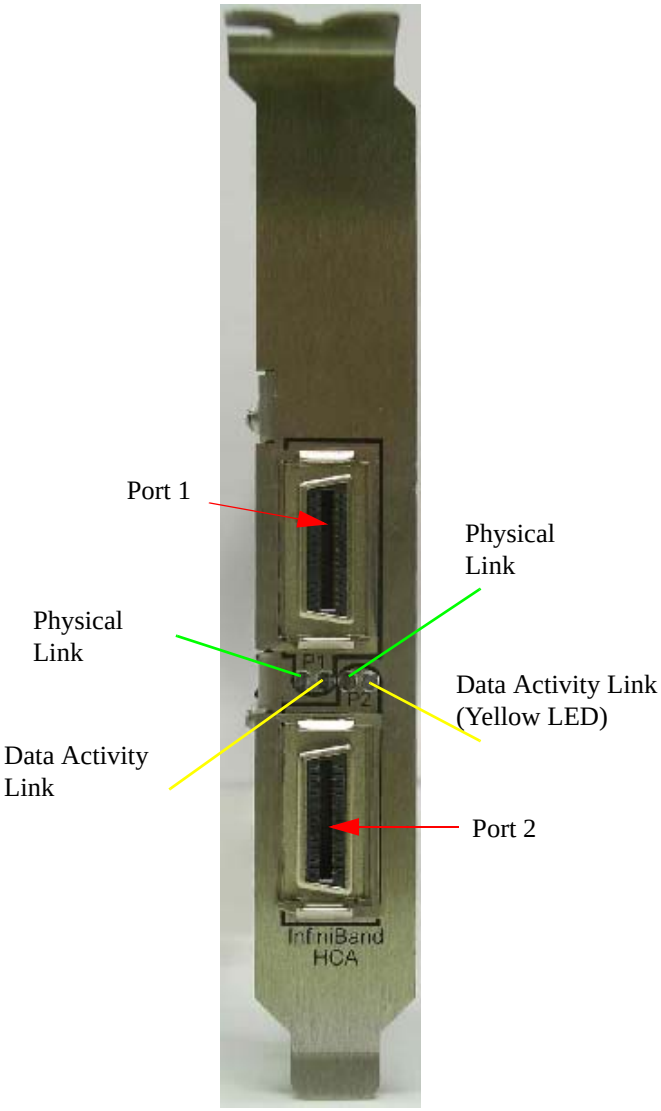


1.0.11 I/O Panel with Dual Ports and LEDs

Figure 6 shows the common I/O panel of all the tall-bracket HCA cards covered in this *User's Manual*. Both IB ports ar shown along with the physical and activity link LEDs.

Note: Short brackets have the same port and LED footprints as tall brackets. See Appendix C, "Instructions for Replacing a Tall Bracket with a Short Bracket on HCA Cards" on page 57.

Figure 6: I/O Panel with Dual Ports and LEDs (Tall Bracket)



Vital Product Data (VPD) Format

The PCI VPD (Vital Product Data) layout for each of the described Mellanox Technologies HCA cards complies with the format defined in the *PCI 2.3 Specification, Appendix I*. All HCA cards share the same PCI VPD layout (i.e., have the same items), however, the "Offset" of each item and/or its "Value" may be different from one card's VPD to another.

The PCI VPD layout for each HCA card is provided in the following sections:

- Section , "PCI VPD Layout for MHEA28-XSC," on page 23
- Section , "PCI VPD Layout for MHEA28-XTC," on page 24
- Section , "PCI VPD Layout for MHGA28-XSC," on page 26
- Section , "PCI VPD Layout for MHGA28-XTC," on page 27
- Section , "PCI VPD Layout for MHEA28-1SC," on page 28
- Section , "PCI VPD Layout for MHEA28-1TC," on page 29
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- Section , "PCI VPD Layout for MHGA28-2SC," on page 37
- Section , "PCI VPD Layout for MHGA28-2TC," on page 38

PCI VPD Layout for MHEA28-XSC

Note: "A1" was used as the HCA card (PCB) revision. Later revisions of the HCA card will have the same format.

Table 11 - MHEA28-XSC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
0	Large Resource Type ID String Tag (0x02)	0x82		
1	Length	0x9		
3	Data	"Lion mini"	Alphanumeric	
12	Large Resource Type VPD-R Tag (0x10)	0x90		
13	Length	0x4F		
15	VPD Keyword	"PN"	Numbers	Add in Card Part Number
17	Length	0x15		
18	Data	"MHEA28-XSC"		
39	VPD Keyword	"EC"	Alphanumeric	Engineering Change Level of the card (rev)
41	Length	0x2		
42	Data	"A1"		PCB revision
46	VPD Keyword	"SN"	Alphanumeric	Serial Number
48	Length	0x18		
49	Data	"00..00XXXX..XX"		
73	VPD Keyword	"V0"		Misc Information

Table 11 - MHEA28-XSC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
75	Length	0x10		
76	Data	“PCIe x8”		
92	VPD Keyword	“RV”		
94	Length	0x1		
95	Data	Checksum		
96	Large Resource Type VPD-W Tag (0x11)	0x91		
97	Length	0x9F		
99	VPD Keyword	“V1”		EFI Driver version
101	Length	0x6		
102	Data	“N/A”	Number	
108	VPD Keyword	“YA”		Asset Tag
110	Length	0x20		
111	Data	“N/A”	Alphanumeric	“N/A”
143	VPD Keyword	“RW”		Remaining read/write area
145	Length	0x6D		
146	Data	Reserved (0x00)		
255	Small Resource Type END Tag (0x11)	0x78		
256	Mellanox Read Only Mask	0x0....0	Numbers	
352	Mellanox Read/Write Mask	0x1...1	Numbers	
511	Mellanox Read Only Mask	0x0	Numbers	

PCI VPD Layout for MHEA28-XTC

Note: “A1” was used as the HCA card (PCB) revision. Later revisions of the HCA card will have the same format.

Table 12 - MHEA28-XTC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
0	Large Resource Type ID String Tag (0x02)	0x82		
1	Length	0x9		
3	Data	“Lion mini”	Alphanumeric	
12	Large Resource Type VPD-R Tag (0x10)	0x90		
13	Length	0x4F		
15	VPD Keyword	“PN”	Numbers	Add in Card Part Number

Table 12 - MHEA28-XTC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
17	Length	0x15		
18	Data	"MHEA28-XTC"		
39	VPD Keyword	"EC"	Alphanumeric	Engineering Change Level of the card (rev)
41	Length	0x2		
42	Data	"A1"		"PCB revision
46	VPD Keyword	"SN"	Alphanumeric	Serial Number
48	Length	0x18		
49	Data	"00..00XXXX..XX"		
73	VPD Keyword	"V0"		Misc Information
75	Length	0x10		
76	Data	"PCIe x8"		
92	VPD Keyword	"RV"		
94	Length	0x1		
95	Data	Checksum		
96	Large Resource Type VPD-W Tag (0x11)	0x91		
97	Length	0x9F		
99	VPD Keyword	"V1"		EFI Driver version
101	Length	0x6		
102	Data	"N/A"	Number	
108	VPD Keyword	"YA"		Asset Tag
110	Length	0x20		
111	Data	"N/A"	Alphanumeric	"N/A"
143	VPD Keyword	"RW"		Remaining read/write area
145	Length	0x6D		
146	Data	Reserved (0x00)		
255	Small Resource Type END Tag (0x11)	0x78		
256	Mellanox Read Only Mask	0x0....0	Numbers	
352	Mellanox Read/Write Mask	0x1...1	Numbers	
511	Mellanox Read Only Mask	0x0	Numbers	

PCI VPD Layout for MHGA28-XSC

Note: “A1” was used as the HCA card (PCB) revision. Later revisions of the HCA card will have the same format.

Table 13 - MHGA28-XSC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
0	Large Resource Type ID String Tag (0x02)	0x82		
1	Length	0xD		
3	Data	“Lion mini DDR”	Alphanumeric	
16	Large Resource Type VPD-R Tag (0x10)	0x90		
17	Length	0x4F		
19	VPD Keyword	“PN”	Numbers	Add in Card Part Number
21	Length	0x15		
22	Data	“MHGA28-XSC”		
43	VPD Keyword	“EC”	Alphanumeric	Engineering Change Level of the card (rev)
45	Length	0x2		
46	Data	“A1”		"PCB revision
48	VPD Keyword	“SN”	Alphanumeric	Serial Number
50	Length	0x18		
51	Data	“00..00XXXX..XX”		
75	VPD Keyword	“V0”		Misc Information
77	Length	0x10		
78	Data	“PCIe x8”		
94	VPD Keyword	“RV”		
96	Length	0x1		
97	Data	Checksum		
98	Large Resource Type VPD-W Tag (0x11)	0x91		
99	Length	0x9A		
101	VPD Keyword	“V1”		EFI Driver version
103	Length	0x6		
104	Data	“N/A”	Number	
110	VPD Keyword	“YA”		Asset Tag
112	Length	0x20		
113	Data	“N/A”	Alphanumeric	“N/A”
145	VPD Keyword	“RW”		Remaining read/write area

Table 13 - MHGA28-XSC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
147	Length	0x6B		
148	Data	Reserved (0x00)		
255	Small Resource Type END Tag (0x11)	0x78		
256	Mellanox Read Only Mask	0x0....0	Numbers	
352	Mellanox Read/Write Mask	0x1...1	Numbers	
511	Mellanox Read Only Mask	0x0	Numbers	

PCI VPD Layout for MHGA28-XTC

Note: "A1" was used as the HCA card (PCB) revision. Later revisions of the HCA card will have the same format.

Table 14 - MHGA28-XTC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
0	Large Resource Type ID String Tag (0x02)	0x82		
1	Length	0xD		
3	Data	"Lion mini DDR"	Alphanumeric	
16	Large Resource Type VPD-R Tag (0x10)	0x90		
17	Length	0x4F		
19	VPD Keyword	"PN"	Numbers	Add in Card Part Number
21	Length	0x15		
22	Data	"MHGA28-XTC"		
43	VPD Keyword	"EC"	Alphanumeric	Engineering Change Level of the card (rev)
45	Length	0x2		
46	Data	"A1"		"PCB revision
48	VPD Keyword	"SN"	Alphanumeric	Serial Number
50	Length	0x18		
51	Data	"00..00XXXX..XX"		
75	VPD Keyword	"V0"		Misc Information
77	Length	0x10		
78	Data	"PCIe x8"		
94	VPD Keyword	"RV"		
96	Length	0x1		
97	Data	Checksum		
98	Large Resource Type VPD-W Tag (0x11)	0x91		

Table 14 - MHGA28-XTC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
99	Length	0x9A		
101	VPD Keyword	“V1”		EFI Driver version
103	Length	0x6		
104	Data	“N/A”	Number	
110	VPD Keyword	“YA”		Asset Tag
112	Length	0x20		
113	Data	“N/A”	Alphanumeric	“N/A”
145	VPD Keyword	“RW”		Remaining read/write area
147	Length	0x6B		
148	Data	Reserved (0x00)		
255	Small Resource Type END Tag (0x11)	0x78		
256	Mellanox Read Only Mask	0x0....0	Numbers	
352	Mellanox Read/Write Mask	0x1...1	Numbers	
511	Mellanox Read Only Mask	0x0	Numbers	

PCI VPD Layout for MHEA28-1SC

Note: “A1” was used as the HCA card (PCB) revision. Later revisions of the HCA card will have the same format.

Table 15 - MHEA28-1SC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
0	Large Resource Type ID String Tag (0x02)	0x82		
1	Length	0x8		
3	Data	“Lion cub”	Alphanumeric	
11	Large Resource Type VPD-R Tag (0x10)	0x90		
12	Length	0x4F		
14	VPD Keyword	“PN”	Numbers	Add in Card Part Number
16	Length	0x15		
17	Data	“MHEA28-1SC”		
38	VPD Keyword	“EC”	Alphanumeric	Engineering Change Level of the card (rev)
40	Length	0x2		
41	Data	“A1”		PCB revision

Table 15 - MHEA28-1SC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
43	VPD Keyword	"SN"	Alphanumeric	Serial Number
45	Length	0x18		
46	Data	"00..00XXXX..XX"		
70	VPD Keyword	"V0"		Misc Information
72	Length	0x10		
73	Data	"PCIe x8"		
89	VPD Keyword	"RV"		
91	Length	0x1		
92	Data	Checksum		
93	Large Resource Type VPD-W Tag (0x11)	0x91		
94	Length	0x9F		
96	VPD Keyword	"V1"		EFI Driver version
98	Length	0x6		
99	Data	"N/A"	Number	
105	VPD Keyword	"YA"		Asset Tag
107	Length	0x20		
108	Data	"N/A"	Alphanumeric	"N/A"
140	VPD Keyword	"RW"		Remaining read/write area
142	Length	0x70		
143	Data	Reserved (0x00)		
255	Small Resource Type END Tag (0x11)	0x78		
256	Mellanox Read Only Mask	0x0....0	Numbers	
352	Mellanox Read/Write Mask	0x1...1	Numbers	
511	Mellanox Read Only Mask	0x0	Numbers	

PCI VPD Layout for MHEA28-1TC

Note: "A1" was used as the HCA card (PCB) revision. Later revisions of the HCA card will have the same format.

Table 16 - MHEA28-1TC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
0	Large Resource Type ID String Tag (0x02)	0x82		
1	Length	0x8		

Table 16 - MHEA28-1TC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
3	Data	“Lion cub”	Alphanumeric	
11	Large Resource Type VPD-R Tag (0x10)	0x90		
12	Length	0x4F		
14	VPD Keyword	“PN”	Numbers	Add in Card Part Number
16	Length	0x15		
17	Data	“MHEA28-1TC”		
38	VPD Keyword	“EC”	Alphanumeric	Engineering Change Level of the card (rev)
40	Length	0x2		
41	Data	“A1”		PCB revision
43	VPD Keyword	“SN”	Alphanumeric	Serial Number
45	Length	0x18		
46	Data	“00..00XXXX..XX”		
70	VPD Keyword	“V0”		Misc Information
72	Length	0x10		
73	Data	“PCIe x8”		
89	VPD Keyword	“RV”		
91	Length	0x1		
92	Data	Checksum		
93	Large Resource Type VPD-W Tag (0x11)	0x91		
94	Length	0x9F		
96	VPD Keyword	“V1”		EFI Driver version
98	Length	0x6		
99	Data	“N/A”	Number	
105	VPD Keyword	“YA”		Asset Tag
107	Length	0x20		
108	Data	“N/A”	Alphanumeric	“N/A”
140	VPD Keyword	“RW”		Remaining read/write area
142	Length	0x70		
143	Data	Reserved (0x00)		
255	Small Resource Type END Tag (0x11)	0x78		
256	Mellanox Read Only Mask	0x0....0	Numbers	
352	Mellanox Read/Write Mask	0x1...1	Numbers	

Table 16 - MHEA28-1TC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
511	Mellanox Read Only Mask	0x0	Numbers	

PCI VPD Layout for MHGA28-1SC

Note: "A1" was used as the HCA card (PCB) revision. Later revisions of the HCA card will have the same format.

Table 17 - MHGA28-1SC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
0	Large Resource Type ID String Tag (0x02)	0x82		
1	Length	0xC		
3	Data	"Lion cub DDR"	Alphanumeric	
15	Large Resource Type VPD-R Tag (0x10)	0x90		
16	Length	0x4F		
18	VPD Keyword	"PN"	Numbers	Add in Card Part Number
20	Length	0x15		
21	Data	"MHGA28-1SC"		
42	VPD Keyword	"EC"	Alphanumeric	Engineering Change Level of the card (rev)
44	Length	0x2		
45	Data	"A1"		PCB revision
47	VPD Keyword	"SN"	Alphanumeric	Serial Number
49	Length	0x18		
50	Data	"00..00XXXX..XX"		
74	VPD Keyword	"V0"		Misc Information
76	Length	0x10		
77	Data	"PCIe x8"		
93	VPD Keyword	"RV"		
95	Length	0x1		
96	Data	Checksum		
97	Large Resource Type VPD-W Tag (0x11)	0x91		
98	Length	0x9B		
100	VPD Keyword	"V1"		EFI Driver version
102	Length	0x6		
103	Data	"N/A"	Number	
109	VPD Keyword	"YA"		Asset Tag

Table 17 - MHGA28-1SC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
111	Length	0x20		
112	Data	“N/A”	Alphanumeric	“N/A”
144	VPD Keyword	“RW”		Remaining read/write area
146	Length	0x6C		
147	Data	Reserved (0x00)		
255	Small Resource Type END Tag (0x11)	0x78		
256	Mellanox Read Only Mask	0x0....0	Numbers	
352	Mellanox Read/Write Mask	0x1...1	Numbers	
511	Mellanox Read Only Mask	0x0	Numbers	

PCI VPD Layout for MHGA28-1TC

Note: “A1” was used as the HCA card (PCB) revision. Later revisions of the HCA card will have the same format.

Table 18 - MHGA28-1TC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
0	Large Resource Type ID String Tag (0x02)	0x82		
1	Length	0xC		
3	Data	“Lion cub DDR”	Alphanumeric	
15	Large Resource Type VPD-R Tag (0x10)	0x90		
16	Length	0x4F		
18	VPD Keyword	“PN”	Numbers	Add in Card Part Number
20	Length	0x15		
21	Data	“MHGA28-1TC”		
42	VPD Keyword	“EC”	Alphanumeric	Engineering Change Level of the card (rev)
44	Length	0x2		
45	Data	“A1”		PCB revision
47	VPD Keyword	“SN”	Alphanumeric	Serial Number
49	Length	0x18		
50	Data	“00..00XXXX..XX”		
74	VPD Keyword	“V0”		Misc Information
76	Length	0x10		
77	Data	“PCIe x8”		

Table 18 - MHGA28-1TC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
93	VPD Keyword	"RV"		
95	Length	0x1		
96	Data	Checksum		
97	Large Resource Type VPD-W Tag (0x11)	0x91		
98	Length	0x9B		
100	VPD Keyword	"V1"		EFI Driver version
102	Length	0x6		
103	Data	"N/A"	Number	
109	VPD Keyword	"YA"		Asset Tag
111	Length	0x20		
112	Data	"N/A"	Alphanumeric	"N/A"
144	VPD Keyword	"RW"		Remaining read/write area
146	Length	0x6C		
147	Data	Reserved (0x00)		
255	Small Resource Type END Tag (0x11)	0x78		
256	Mellanox Read Only Mask	0x0....0	Numbers	
352	Mellanox Read/Write Mask	0x1...1	Numbers	
511	Mellanox Read Only Mask	0x0	Numbers	

PCI VPD Layout for MHGA28D-1TC

Note: "A1" was used as the HCA card (PCB) revision. Later revisions of the HCA card will have the same format.

Table 19 - MHGA28D-1TC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
0	Large Resource Type ID String Tag (0x02)	0x82		
1	Length	0xC		
3	Data	"Lion cub DDR"	Alphanumeric	
15	Large Resource Type VPD-R Tag (0x10)	0x90		
16	Length	0x4F		
18	VPD Keyword	"PN"	Numbers	Add in Card Part Number
20	Length	0x15		
21	Data	"MHGA28D-1TC"		

Table 19 - MHGA28D-1TC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
42	VPD Keyword	“EC”	Alphanumeric	Engineering Change Level of the card (rev)
44	Length	0x2		
45	Data	"A1”		PCB revision
47	VPD Keyword	“SN”	Alphanumeric	Serial Number
49	Length	0x18		
50	Data	“00..00XXXX..XX”		
74	VPD Keyword	“V0”		Misc Information
76	Length	0x10		
77	Data	“PCIe x8”		
93	VPD Keyword	“RV”		
95	Length	0x1		
96	Data	Checksum		
97	Large Resource Type VPD-W Tag (0x11)	0x91		
98	Length	0x9B		
100	VPD Keyword	“V1”		EFI Driver version
102	Length	0x6		
103	Data	“N/A”	Number	
109	VPD Keyword	“YA”		Asset Tag
111	Length	0x20		
112	Data	“N/A”	Alphanumeric	“N/A”
144	VPD Keyword	“RW”		Remaining read/write area
146	Length	0x6c		
147	Data	Reserved (0x00)		
255	Small Resource Type END Tag (0x11)	0x78		
256	Mellanox Read Only Mask	0x0....0	Numbers	
356	Mellanox Read/Write Mask	0x1...1	Numbers	
511	Mellanox Read Only Mask	0x0	Numbers	

PCI VPD Layout for MHEA28-2SC

Note: "A1" was used as the HCA card (PCB) revision. Later revisions of the HCA card will have the same format.

Table 20 - MHEA28-2SC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
0	Large Resource Type ID String Tag (0x02)	0x82		
1	Length	0x8		
3	Data	"Lion cub"	Alphanumeric	
11	Large Resource Type VPD-R Tag (0x10)	0x90		
12	Length	0x4F		
14	VPD Keyword	"PN"	Numbers	Add in Card Part Number
16	Length	0x15		
17	Data	"MHEA28-2SC"		
38	VPD Keyword	"EC"	Alphanumeric	Engineering Change Level of the card (rev)
40	Length	0x2		
41	Data	"A1"		PCB revision
43	VPD Keyword	"SN"	Alphanumeric	Serial Number
45	Length	0x18		
46	Data	"00..00XXXX..XX"		
70	VPD Keyword	"V0"		Misc Information
72	Length	0x10		
73	Data	"PCIe x8"		
89	VPD Keyword	"RV"		
91	Length	0x1		
92	Data	Checksum		
93	Large Resource Type VPD-W Tag (0x11)	0x91		
94	Length	0x9F		
96	VPD Keyword	"V1"		EFI Driver version
98	Length	0x6		
99	Data	"N/A"	Number	
105	VPD Keyword	"YA"		Asset Tag
107	Length	0x20		
108	Data	"N/A"	Alphanumeric	"N/A"
140	VPD Keyword	"RW"		Remaining read/write area

Table 20 - MHEA28-2SC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
142	Length	0x70		
143	Data	Reserved (0x00)		
255	Small Resource Type END Tag (0x11)	0x78		
256	Mellanox Read Only Mask	0x0....0	Numbers	
352	Mellanox Read/Write Mask	0x1...1	Numbers	
511	Mellanox Read Only Mask	0x0	Numbers	

PCI VPD Layout for MHEA28-2TC

Note: “A1” was used as the HCA card (PCB) revision. Later revisions of the HCA card will have the same format.

Table 21 - MHEA28-2TC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
0	Large Resource Type ID String Tag (0x02)	0x82		
1	Length	0x8		
3	Data	“Lion cub”	Alphanumeric	
11	Large Resource Type VPD-R Tag (0x10)	0x90		
12	Length	0x4F		
14	VPD Keyword	“PN”	Numbers	Add in Card Part Number
16	Length	0x15		
17	Data	“MHEA28-2TC”		
38	VPD Keyword	“EC”	Alphanumeric	Engineering Change Level of the card (rev)
40	Length	0x2		
41	Data	“A1”		PCB revision
43	VPD Keyword	“SN”	Alphanumeric	Serial Number
45	Length	0x18		
46	Data	“00..00XXXX..XX”		
70	VPD Keyword	“V0”		Misc Information
72	Length	0x10		
73	Data	“PCIe x8”		
89	VPD Keyword	“RV”		
91	Length	0x1		
92	Data	Checksum		

Table 21 - MHEA28-2TC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
93	Large Resource Type VPD-W Tag (0x11)	0x91		
94	Length	0x9F		
96	VPD Keyword	"V1"		EFI Driver version
98	Length	0x6		
99	Data	"N/A"	Number	
105	VPD Keyword	"YA"		Asset Tag
107	Length	0x20		
108	Data	"N/A"	Alphanumeric	"N/A"
140	VPD Keyword	"RW"		Remaining read/write area
142	Length	0x70		
143	Data	Reserved (0x00)		
255	Small Resource Type END Tag (0x11)	0x78		
256	Mellanox Read Only Mask	0x0....0	Numbers	
352	Mellanox Read/Write Mask	0x1...1	Numbers	
511	Mellanox Read Only Mask	0x0	Numbers	

PCI VPD Layout for MHGA28-2SC

Note: "A1" was used as the HCA card (PCB) revision. Later revisions of the HCA card will have the same format.

Table 22 - MHGA28-2SC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
0	Large Resource Type ID String Tag (0x02)	0x82		
1	Length	0xC		
3	Data	"Lion cub DDR"	Alphanumeric	
15	Large Resource Type VPD-R Tag (0x10)	0x90		
16	Length	0x4F		
18	VPD Keyword	"PN"	Numbers	Add in Card Part Number
20	Length	0x15		
21	Data	"MHGA28-2SC"		
42	VPD Keyword	"EC"	Alphanumeric	Engineering Change Level of the card (rev)
44	Length	0x2		
45	Data	"A1"		PCB revision

Table 22 - MHGA28-2SC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
47	VPD Keyword	“SN”	Alphanumeric	Serial Number
49	Length	0x18		
50	Data	“00..00XXXX..XX”		
74	VPD Keyword	“V0”		Misc Information
76	Length	0x10		
77	Data	“PCIe x8”		
93	VPD Keyword	“RV”		
95	Length	0x1		
96	Data	Checksum		
97	Large Resource Type VPD-W Tag (0x11)	0x91		
98	Length	0x9B		
100	VPD Keyword	“V1”		EFI Driver version
102	Length	0x6		
103	Data	“N/A”	Number	
109	VPD Keyword	“YA”		Asset Tag
111	Length	0x20		
112	Data	“N/A”	Alphanumeric	“N/A”
144	VPD Keyword	“RW”		Remaining read/write area
146	Length	0x6C		
147	Data	Reserved (0x00)		
255	Small Resource Type END Tag (0x11)	0x78		
256	Mellanox Read Only Mask	0x0....0	Numbers	
352	Mellanox Read/Write Mask	0x1...1	Numbers	
511	Mellanox Read Only Mask	0x0	Numbers	

PCI VPD Layout for MHGA28-2TC

Note: “A1” was used as the HCA card (PCB) revision. Later revisions of the HCA card will have the same format.

Table 23 - MHGA28-2TC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
0	Large Resource Type ID String Tag (0x02)	0x82		
1	Length	0xC		
3	Data	“Lion cub DDR”	Alphanumeric	

Table 23 - MHGA28-2TC VPD Layout

Offset (Decimal)	Item	Value	Format	Description
15	Large Resource Type VPD-R Tag (0x10)	0x90		
16	Length	0x4F		
18	VPD Keyword	"PN"	Numbers	Add in Card Part Number
20	Length	0x15		
21	Data	"MHGA28-2TC"		
42	VPD Keyword	"EC"	Alphanumeric	Engineering Change Level of the card (rev)
44	Length	0x2		
45	Data	"A1"		PCB revision
47	VPD Keyword	"SN"	Alphanumeric	Serial Number
49	Length	0x18		
50	Data	"00..00XXXX..XX"		
74	VPD Keyword	"V0"		Misc Information
76	Length	0x10		
77	Data	"PCIe x8"		
93	VPD Keyword	"RV"		
95	Length	0x1		
96	Data	Checksum		
97	Large Resource Type VPD-W Tag (0x11)	0x91		
98	Length	0x9B		
100	VPD Keyword	"V1"		EFI Driver version
102	Length	0x6		
103	Data	"N/A"	Number	
109	VPD Keyword	"YA"		Asset Tag
111	Length	0x20		
112	Data	"N/A"	Alphanumeric	"N/A"
144	VPD Keyword	"RW"		Remaining read/write area
146	Length	0x6C		
147	Data	Reserved (0x00)		
255	Small Resource Type END Tag (0x11)	0x78		
256	Mellanox Read Only Mask	0x0....0	Numbers	
352	Mellanox Read/Write Mask	0x1...1	Numbers	
511	Mellanox Read Only Mask	0x0	Numbers	

Appendix A: Specifications

A.1 EMC Certification Statements

Table 24 lists the approved certification status per HCA card in different regions of the world.

Table 24 - HCA Cards Certification Status

HCA Card P/N	FCC Class (USA)	EN Class (Europe)	ICES Class (Canada)	C-Tick (Australia and New Zealand)	VCCI (Japan)	MIC (Korea)
MHEA28-XSC	B	B	B	✔	A	–
MHEA28-XTC	B	B	B	✔	A	–
MHGA28-XSC	A	A	A	✔	A	–
MHGA28-XTC	A	A	A	✔	A	–
MHEA28-1SC	B	B	B		B	A
MHEA28-1TC	B	B	B		B	A
MHGA28-1SC	A	A	A		A	A
MHGA28-1TC	A	A	A		A	A
MHGA28D-1TC	A	A	A			–
MHEA28-2SC	A	A	A		A	–
MHEA28-2TC	B	B	B		B	–
MHGA28-2SC	Not available					
MHGA28-2TC						

A.1.1 FCC Statements (USA)

Class A Statements:

§ 15.21

Statement

Warning! Changes or modifications to this equipment not expressly approved by the party responsible for compliance (Mellanox Technologies) could void the user's authority to operate the equipment.

§15.105(a)

Statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

A.1.2 EN Statements (Europe)

EN55022 Class A Statement:

Warning

This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

A.1.3 ICES Statements (Canada)

Class A Statement:

“This Class A digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.”

A.1.4 VCCI Statements (Japan)

Class A Statement:

この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に基づくクラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

(Translation - "This is a Class A product based on the standard of the Voluntary Control Council for Interference by Information Technology Equipment (VCCI). If this equipment is used in a domestic environment, radio interference may occur, in which case the user may be required to take corrective actions.")

A.1.5 MIC Statement (Republic of Korea)

Korea's "Regulation for Certification of Information and Communication Equipment," requires EMC testing and certification for many electronic products. Korean EMC certifications are issued by Radio Research Laboratory (RRL), which is organized under the Ministry of Information and Communications (MIC). EMC testing includes electromagnetic emissions (EMI) and susceptibility (EMS). Certified equipment is labeled with the MIC mark and certification number.

Class A Statement:

이 기기는 업무용으로 전자파적합등록을 한 기기이오니 판매자 또는 사용자는 이 점을 주의하시기 바라며 만약 잘못 판매 또는 구입하였을 때에는 가정용으로 교환하시기 바랍니다.

Translation:

Class A Device: This device is registered for EMC requirements for industrial use. The seller or buyer should be aware of this. If this type was sold or purchased by mistake, it should be replaced with a residential-use type.

A.2 MHEA28-XSC and MHEA28-XTC Specifications

Table 25 lists the specifications for the mem-free HCA cards listed in Table 3 on page 10 with IB running at *SDR*.

Table 25 - Specifications for Mem-free HCA Cards - IB @ *SDR*

Physical		**Power and Environmental**	
Size:	2.5in. x 4.6in. (6.4cm x 11.7cm)	Voltage:	12V, 3.3V
Air Flow:	200LFM @55°C	Maximum Power:	7.8W
4X 10Gb/s Connector:	InfiniBand (Copper, current rating: 0.5A max) with active media adapter support	Temperature:	0°C to 55°C
On-board Memory Size:	0MB		
Protocol Support		**Regulatory**	
InfiniBand:	IBTA v1.2, Auto-Negotiation 10Gb/s, 2.5Gb/s	• EMC:	
QoS:	8 InfiniBand Virtual Lanes for each port	CTUVUS:	UL60950-1:2003R7.06 CAN/CSA-C22.2 No.60950-1-03
RDMA Support:	Yes, All Ports		IEC/EN 60950-1:2001
			ETSI EN 300 019-2-2
		RoHS:	IEC 60068-2- 64, 29, 32
			FCC 47 CFR part 15:2005, subpart B, class B
			ICES-003:2004 Issue 4, class B
			VCCI V-3/2005.04, class B
			EN 55022:1998+A1:2000+A2:2003 class B, EN 61000-3-2:2000+A2:2005, EN61000-3-3:1995+A1:2000, EN 55024:1998 + A1(2001)+A2(2003) standards, harmonized under EMC Directive 89/336/EEC;
			RoHS-R5

A.3 MHGA28-XSC and MHGA28-XTC Specifications

Table 26 lists the specifications for the mem-free HCA cards listed in Table 3 on page 10 with IB running at *DDR*.

Table 26 - Specifications for Mem-free HCA Cards - IB @ *DDR*

Physical		**Power and Environmental**	
Size:	2.5in. x 4.6in. (6.4cm x 11.7cm)	Voltage:	12V, 3.3V
Air Flow:	200LFM @55°C	Maximum Power:	10.3W
4X 20Gb/s Connector:	InfiniBand (Copper, current rating: 0.5A max) with active media adapter support	Temperature:	0°C to 55°C
On-board Memory Size:	0MB		
Protocol Support		**Regulatory**	
InfiniBand:	IBTA v1.2, Auto-Negotiation[a] (20Gb/s, 5Gb/s) or (10Gb/s, 2.5Gb/s)	EMC:	FCC 47 CFR part 15:2005, subpart B, class A
QoS:	8 InfiniBand Virtual Lanes for each port		ICES-003:2004 Issue 4, class A
RDMA Support:	Yes, All Ports		VCCI V-3/2005.04, class A
			EN 55022:1998+A1:2000+A2:2003 class A, EN 61000-3-2:2000+A2:2005, EN61000-3-3:1995+A1:2000, EN 55024:1998 + A1(2001)+A2(2003) standards, harmonized under EMC Directive 89/336/EEC;
		CTUVUS:	UL60950-1:2003R7.06 CAN/CSA-C22.2 No.60950-1-03
		Safety:	IEC/EN 60950-1:2001 ETSI EN 300 019-2-2
		Environmental:	IEC 60068-2- 64, 29, 32
		RoHS:	RoHS-R5

a. The auto-negotiation protocol is proprietary of Mellanox Technologies and compliant with the *InfiniBand Architecture Specification, Release 1.2*.

A.4 MHEA28-1SC and MHEA28-1TC Specifications

Table 27 lists the specifications for the HCA cards with 128MB on-board memory listed in Table 4 on page 11 and IB running at *SDR*.

Table 27 - Specifications for HCA Cards with 128MB On-board Memory - IB @ *SDR*

Physical		**Power and Environmental**	
Size:	2.5in. x 6.6in. (6.4cm x 16.8cm)	Voltage:	12V, 3.3V
Air Flow:	200LFM @55°C	Maximum Power:	10.5W
4X 10Gb/s Connector:	InfiniBand (Copper, current rating: 0.5A max) with active media adapter support	Temperature:	0°C to 55°C
On-board Memory Size:	128MB		
Protocol Support		**Regulatory**	
InfiniBand:	IBTA v1.2, Auto-Negotiation 10Gb/s, 2.5Gb/s	EMC:	FCC 47 CFR part 15:2005, subpart B, class B
QoS:	8 InfiniBand Virtual Lanes for each port		ICES-003:2004 Issue 4, class B
RDMA Support:	Yes, All Ports		VCCI V-3/2005.04, class B MIC Class A EN 55022:1998+A1:2000+A2:2003 class B, EN 61000-3-2:2000+A2:2005, EN61000-3-3:1995+A1:2000, EN 55024:1998 + A1(2001)+A2(2003) standards, harmonized under EMC Directive 89/336/EEC;
		CTUVUS:	UL60950-1:2003R7.06 CAN/CSA-C22.2 No.60950-1-03
		Safety:	IEC/EN 60950-1:2001 ETSI EN 300 019-2-2
		Environmental:	IEC 60068-2- 64, 29, 32
		RoHS:	RoHS-R5

A.5 MHGA28-1SC Specifications

Table 28 lists the specifications for the MHGA28-1SC Short Bracket HCA card (with 128MB on-board memory and IB running at *DDR)*.

Table 28 - Specifications for MHGA28-1SC (128MB, Short Bracket, IB @ *DDR*)

Physical		**Power and Environmental**	
Size:	2.5in. x 6.6in. (6.4cm x 16.8cm)	Voltage:	12V, 3.3V
Air Flow:	200LFM @55°C	Maximum Power:	12.7W
4X 20Gb/s Connector:	InfiniBand (Copper, current rating: 0.5A max) with active media adapter support	Temperature:	0°C to 55°C
On-board Memory Size:	128MB		
Protocol Support		**Regulatory**	
InfiniBand:	IBTA v1.2, Auto-Negotiation[a] (20Gb/s, 5Gb/s) or (10Gb/s, 2.5Gb/s)	EMC:	FCC 47 CFR part 15:2005, subpart B, class A ICES-003:2004 Issue 4, class A VCCI V-3/2005.04, class A MIC class A EN 55022:1998+A1:2000+A2:2003 class A, EN 61000-3-2:2000+A2:2005, EN61000-3-3:1995+A1:2000, EN 55024:1998 + A1(2001)+A2(2003) standards, harmonized under EMC Directive 89/336/EEC;
QoS:	8 InfiniBand Virtual Lanes for each port	CTUVUS:	UL60950-1:2003R7.06 CAN/CSA-C22.2 No.60950-1-03
RDMA Support:	Yes, All Ports	Safety:	IEC/EN 60950-1:2001 ETSI EN 300 019-2-2
		Environmental:	IEC 60068-2- 64, 29, 32
		RoHS:	RoHS-R5

a. The auto-negotiation protocol is proprietary of Mellanox Technologies and compliant with the *InfiniBand Architecture Specification, Release 1.2*.

A.6 MHGA28-1TC Specifications

Table 28 lists the specifications for the MHGA28-1TC Tall Bracket HCA card (with 128MB on-board memory and IB running at *DDR)*.

Table 29 - Specifications for MHGA28-1TC (128MB, Tall Bracket, IB @ *DDR*)

Physical		**Power and Environmental**	
Size:	2.5in. x 6.6in. (6.4cm x 16.8cm)	Voltage:	12V, 3.3V
Air Flow:	200LFM @55°C	Maximum Power:	12.7W
4X 20Gb/s Connector:	InfiniBand (Copper, current rating: 0.5A max) with active media adapter support	Temperature:	0°C to 55°C
On-board Memory Size:	128MB		
Protocol Support		**Regulatory**	
InfiniBand:	IBTA v1.2, Auto-Negotiation[a] (20Gb/s, 5Gb/s) or (10Gb/s, 2.5Gb/s)	EMC:	FCC 47 CFR part 15:2005, subpart B, class A ICES-003:2004 Issue 4, class A VCCI V-3/2005.04, class A MIC class A EN 55022:1998+A1:2000+A2:2003 class A, EN 61000-3-2:2000+A2:2005, EN61000-3-3:1995+A1:2000, EN 55024:1998 + A1(2001)+A2(2003) standards, harmonized under EMC Directive 89/336/EEC;
QoS:	8 InfiniBand Virtual Lanes for each port	CTUVUS:	UL60950-1:2003R7.06 CAN/CSA-C22.2 No.60950-1-03
RDMA Support:	Yes, All Ports	Safety:	IEC/EN 60950-1:2001 ETSI EN 300 019-2-2
		Environmental:	IEC 60068-2- 64, 29, 32
		RoHS:	RoHS-R5

a. The auto-negotiation protocol is proprietary of Mellanox Technologies and compliant with the *InfiniBand Architecture Specification, Release 1.2*.

A.7 MHGA28D-1TC Specifications

Table 28 lists the specifications for the MHGA28D-1TC Tall Bracket HCA card (with 128MB on-board memory and IB running at *DDR)*.

Table 30 - Specifications for MHGA28D-1TC (128MB, Tall Bracket, IB *@ DDR*)

Physical		**Power and Environmental**	
Size:	2.5in. x 6.6in. (6.4cm x 16.8cm)	Voltage:	12V, 3.3V
Air Flow:	200LFM @55°C	Maximum Power:	12.7W
4X 20Gb/s Connector:	InfiniBand (Copper, current rating: 0.5A max) with active media adapter support	Temperature:	0°C to 55°C
On-board Memory Size:	128MB		
Protocol Support		**Regulatory**	
InfiniBand:	IBTA v1.2, Auto-Negotiation[a] (20Gb/s, 5Gb/s) or (10Gb/s, 2.5Gb/s)	EMC:	FCC 47 CFR part 15:2005, subpart B, class A ICES-003:2004 Issue 4, class A VCCI V-3/2005.04, class A MIC class A EN 55022:1998+A1:2000+A2:2003 class A, EN 61000-3-2:2000+A2:2005, EN61000-3-3:1995+A1:2000, EN 55024:1998 + A1(2001)+A2(2003) standards, harmonized under EMC Directive 89/336/EEC;
QoS:	8 InfiniBand Virtual Lanes for each port	CTUVUS:	UL60950-1:2003R7.06 CAN/CSA-C22.2 No.60950-1-03
RDMA Support:	Yes, All Ports	Safety:	IEC/EN 60950-1:2001 ETSI EN 300 019-2-2
		Environmental:	IEC 60068-2- 64, 29, 32
		RoHS:	RoHS-R5

a. The auto-negotiation protocol is proprietary of Mellanox Technologies and compliant with the *InfiniBand Architecture Specification, Release 1.2*.

A.8 MHEA28-2SC Specifications

Table 32 lists the specifications for the MHEA28-2SC Short Bracket HCA card with 256MB on-board memory and IB running at *SDR*.

Table 31 - Specifications for MHEA28-2SC (256MB, Short Bracket, IB *@ SDR*)

Physical		**Power and Environmental**	
Size:	2.5in. x 6.6in. (6.4cm x 16.8cm)	Voltage:	12V, 3.3V
Air Flow:	200LFM @55°C	Maximum Power:	10.5W
4X 10Gb/s Connector:	InfiniBand (Copper, current rating: 0.5A max) with active media adapter support	Temperature:	0°C to 55°C
On-board Memory Size:	256MB		
Protocol Support		**Regulatory**	
InfiniBand:	IBTA v1.2, Auto-Negotiation 10Gb/s, 2.5Gb/s	EMC:	FCC 47 CFR part 15:2005, subpart B, class A
QoS:	8 InfiniBand Virtual Lanes for each port		ICES-003:2004 Issue 4, class A
RDMA Support:	Yes, All Ports		VCCI V-3/2005.04, class A
			EN 55022:1998+A1:2000+A2:2003 class A, EN 61000-3-2:2000+A2:2005, EN61000-3-3:1995+A1:2000, EN 55024:1998 + A1(2001)+A2(2003) standards, harmonized under EMC Directive 89/336/EEC;
		CTUVUS:	UL60950-1:2003R7.06 CAN/CSA-C22.2 No.60950-1-03
		Safety:	IEC/EN 60950-1:2001 ETSI EN 300 019-2-2
		Environmental:	IEC 60068-2- 64, 29, 32
		RoHS:	RoHS-R5

A.9 MHEA28-2TC Specifications

Table 32 lists the specifications for the MHEA28-2TC Tall Bracket HCA card with 256MB on-board memory and IB running at *SDR*.

Table 32 - Specifications for MHEA28-2TC (256MB, Tall Bracket, IB *@ SDR*)

Physical		**Power and Environmental**	
Size:	2.5in. x 6.6in. (6.4cm x 16.8cm)	Voltage:	12V, 3.3V
Air Flow:	200LFM @55°C	Maximum Power:	10.5W
4X 10Gb/s Connector:	InfiniBand (Copper, current rating: 0.5A max) with active media adapter support	Temperature:	0°C to 55°C
On-board Memory Size:	256MB		
Protocol Support		**Regulatory**	
InfiniBand:	IBTA v1.2, Auto-Negotiation 10Gb/s, 2.5Gb/s	EMC:	FCC 47 CFR part 15:2005, subpart B, class A
QoS:	8 InfiniBand Virtual Lanes for each port		ICES-003:2004 Issue 4, class A
RDMA Support:	Yes, All Ports		VCCI V-3/2005.04, class A
			EN 55022:1998+A1:2000+A2:2003 class A, EN 61000-3-2:2000+A2:2005, EN61000-3-3:1995+A1:2000, EN 55024:1998 + A1(2001)+A2(2003) standards, harmonized under EMC Directive 89/336/EEC;
		CTUVUS:	UL60950-1:2003R7.06 CAN/CSA-C22.2 No.60950-1-03
		Safety:	IEC/EN 60950-1:2001 ETSI EN 300 019-2-2
		Environmental:	IEC 60068-2- 64, 29, 32
		RoHS:	RoHS-R5

A.10 MHGA28-2SC and MHGA28-2TC Specifications

Table 33 lists the specifications for HCA cards with 256MB on-board memory listed in Table 4 on page 11 and IB running at *DDR*.

Table 33 - Specifications for HCA Cards with 256MB On-board Memory - IB @ *DDR*

Physical		**Power and Environmental**	
Size:	2.5in. x 6.6in. (6.4cm x 16.8cm)	Voltage:	12V, 3.3V
Air Flow:	200LFM @55°C	Maximum Power:	12.7W
4X 20Gb/s Connector:	InfiniBand (Copper, current rating: 0.5A max) with active media adapter support	Temperature:	0°C to 55°C
On-board Memory Size:	256MB		
Protocol Support		**Regulatory**	
InfiniBand:	IBTA v1.2, Auto-Negotiation[a] (20Gb/s, 5Gb/s) or (10Gb/s, 2.5Gb/s)	CTUVUS:	UL60950-1:2003R7.06 CAN/CSA-C22.2 No.60950-1-03
QoS:	8 InfiniBand Virtual Lanes for each port		
RDMA Support:	Yes, All Ports		

a. The auto-negotiation protocol is proprietary of Mellanox Technologies and compliant with the *InfiniBand Architecture Specification, Release 1.2*.

Appendix B: Interface Connectors Pinout

B.1 I2C-compatible Connector Pinout

Figure 7: I2C-compatible Connector

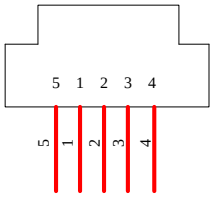


Table 34 - I2C-compatible Connector Pinout

Connector Pin Number	HCA Signal Name
1	SPSDA
2	SPSCL
3	GND
4	NC
5	NC

B.2 InfiniBand Connector Pinout

Figure 8: InfiniBand 4X Port Connector

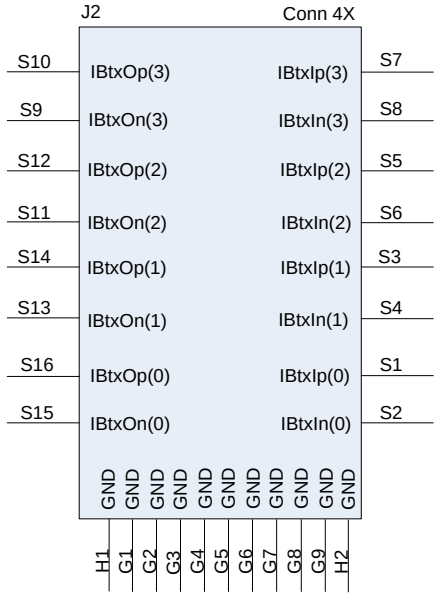


Table 35 - InfiniBand 4X Connector Pinout (Sheet 1 of 2)

Connector Pin Number	Connector Pin Name	IB Port A Signal Name	IB Port B Signal Name
S1	IBtxIp(0)	Rx_A1	Rx_B1
S2	IBtxIn(0)	Rx_A0	Rx_B0
S3	IBtxIp(1)	Rx_A3	Rx_B3
S4	IBtxIn(1)	Rx_A2	Rx_B2
S5	IBtxIp(2)	Rx_A5	Rx_B5
S6	IBtxIn(2)	Rx_A4	Rx_B4
S7	IBtxIp(3)	Rx_A7	Rx_B7
S8	IBtxIn(3)	Rx_A6	Rx_B6
S9	IBtxOn(3)	Tx_A6	Tx_B6
S10	IBtxOp(3)	Tx_A7	Tx_B7
S11	IBtxOn(2)	Tx_A4	Tx_B4
S12	IBtxOp(2)	Tx_A5	Tx_B5
S13	IBtxOn(1)	Tx_A2	Tx_B2

Table 35 - InfiniBand 4X Connector Pinout (Sheet 2 of 2)

Connector Pin Number	Connector Pin Name	IB Port A Signal Name	IB Port B Signal Name
S14	IBtxOp(1)	Tx_A3	Tx_B3
S15	IBtxOn(0)	Tx_A0	Tx_B0
S16	IBtxOp(0)	Tx_A1	Tx_B1
G1-G6, G9, H1-H2	Signal Ground	GND	GND
G7[a]	Sense-3.3V	SENSE_P1	SENSE_P2
G8	Vcc	MC_POWER_P1	MC_POWER_P2

a. The Sense-3.3V signal is used to enable the Vcc power supply pin (G8) used to provide power to the active media adapter.

B.3 PCI Express x8 Connector Pinout

Figure 9: PCI Express x8 Connector

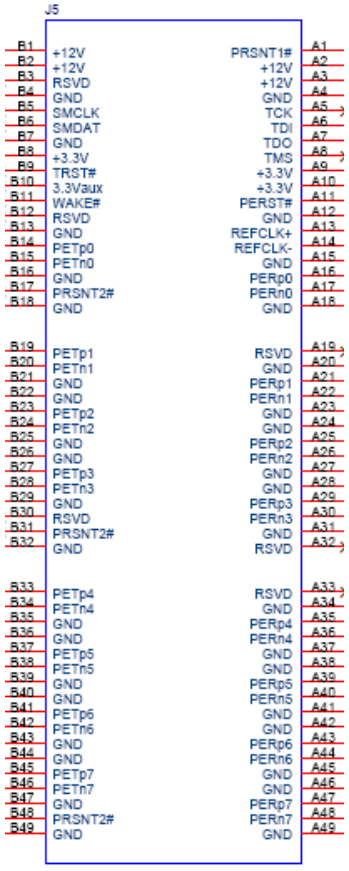


Table 36 - PCI Express x8 Connector Pinout (Sheet 1 of 3)

Pin Number	Side B Connector		Side A Connector	
	Connector Pin Name	PCI Ex Port Signal Name	Connector Pin Name	PCI Ex Port Signal Name
1	+12V	+12V	PRSNT#	Hot plug presence detect
2	+12V	+12V	+12V	+12V
3	RSVD	NC	+12V	+12V
4	GND	GND	GND	GND
5	SMCLK	NC	TCK	NC
6	SMDAT	NC	TDI	TDI2TDO
7	GND	GND	TDO	TDI2TDO
8	+3.3V	+3.3V	TMS	NC
9	TRST#	NC	+3.3V	+3.3V
10	+3.3Vaux	NC	+3.3V	+3.3V
11	WAKE#	NC	PERST#	RST#
12	RSVD	NC	GND	GND
13	GND	GND	REFCLK+	REFCLKp_PCI
14	PETp0	PERP0	REFCLK-	REFCLKn_PCI
15	PETn0	PERN0	GND	GND
16	GND	GND	PERp0	PETP0

Table 36 - PCI Express x8 Connector Pinout (Sheet 2 of 3)

Pin Number	Side B Connector		Side A Connector	
	Connector Pin Name	PCI Ex Port Signal Name	Connector Pin Name	PCI Ex Port Signal Name
17	PRSNT2#	NC	PERn0	PETN0
18	GND	GND	GND	GND
19	PETp1	PERP1	RSVD	NC
20	PETn1	PERN1	GND	GND
21	GND	GND	PERp1	PETP1
22	GND	GND	PERn1	PETN1
23	PETp2	PERP2	GND	GND
24	PETn2	PERN2	GND	GND
25	GND	GND	PERp2	PETP2
26	GND	GND	PERn2	PETN2
27	PETp3	PERP3	GND	GND
28	PETn3	PERN3	GND	GND
29	GND	GND	PERp3	PETP3
30	RSVD	NC	PERn3	PETN3
31	PRSNT2#	NC	GND	GND
32	GND	GND	RSVD	NC
33	PETp4	PERP4	RSVD	NC
34	PETn4	PERN4	GND	GND
35	GND	GND	PERp4	PETP4
36	GND	GND	PERn4	PETN4
37	PETp5	PERP5	GND	GND
38	PETn5	PERN5	GND	GND
39	GND	GND	PERp5	PETP5
40	GND	GND	PERn5	PETN5
41	PETp6	PERP6	RSVD	NC
42	PETn6	PERN6	GND	GND
43	GND	GND	PERp7	PETP7
44	GND	GND	PERn7	PETN7
45	PETp8	PERP8	GND	GND
46	PETn8	PERN8	GND	GND
47	GND	GND	PERp8	PETP8
48	PRSNT2#	PRSNT#	PERn8	PETN8

Table 36 - PCI Express x8 Connector Pinout (Sheet 3 of 3)

Pin Number	Side B Connector		Side A Connector	
	Connector Pin Name	PCI Ex Port Signal Name	Connector Pin Name	PCI Ex Port Signal Name
49	GND	GND	GND	GND

Appendix C: Instructions for Replacing a Tall Bracket with a Short Bracket on HCA Cards

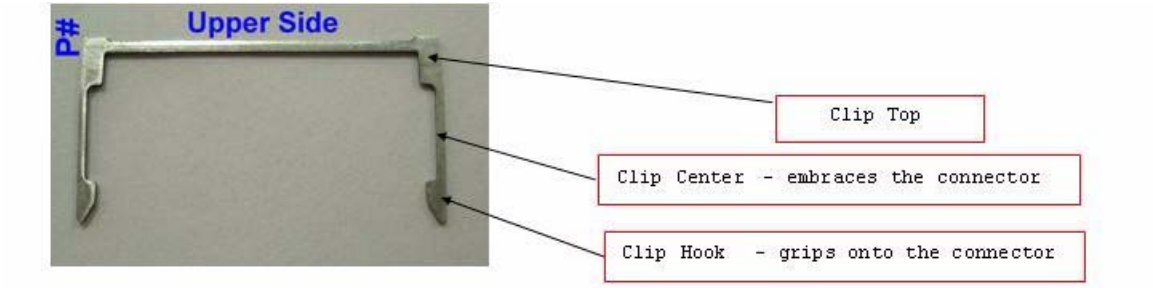
This appendix provides instructions on how to remove a tall bracket of an HCA card such as the one shown in Figure 10 and replace it with a short one.

Figure 10: Tall Bracket of a Dual IB Port HCA Card

C.1 Removing Tall Bracket

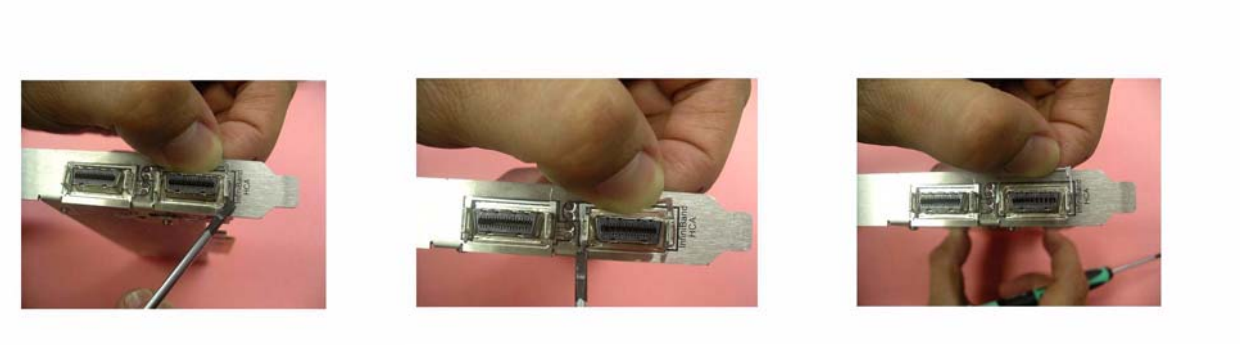
Step 1 - Remove connector clips. Figure 11 shows a connector retention clip and the designated names of its sections.

Figure 11: Connector Retention Clip



Using a small flat head screwdriver, gently push up one hook of a connector's clip toward the connector's top side as shown in Figure 12 (a) on page 58. Then push the other hook each of the two clip's hook towards the connector's top side - see Figure 12 (b). Finally, pull the clip away from its center - see Figure 12 (c).

Figure 12: Extracting Connector Clip

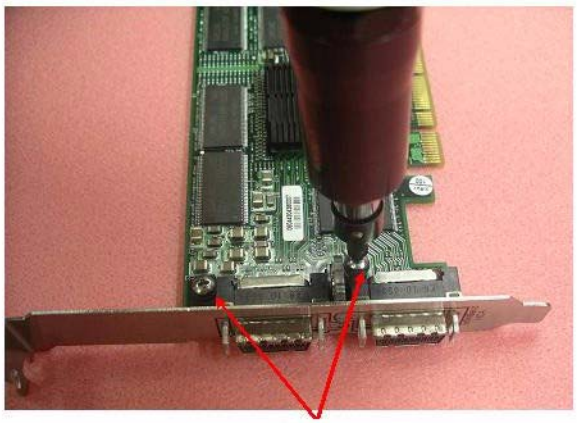


(a) Gently Push One Hook of Clip (b) Gently Push Other Hook of Clip (c) Pull Clip Away

Repeat the above actions for the second connector's clip.

Step 2 - Unscrew bracket screws. Unscrew both screws from the card using a torque screwdriver as shown in Figure 13.

Figure 13: Unscrew Bracket Screws



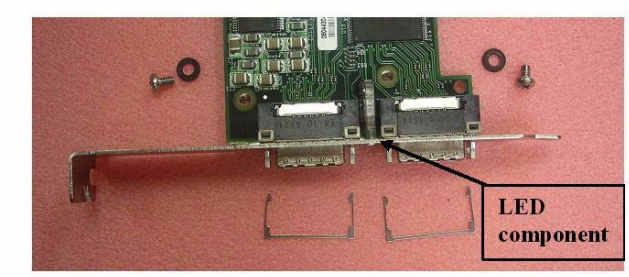
Step 3 - Detach bracket. Grip the bracket as shown in Figure 14 placing your thumb on the LED component. In a rotating move toward the component side of the card, slide the bracket out of the connectors (Figure 14 (c)).

> Gently hold your thumb on the LED component.

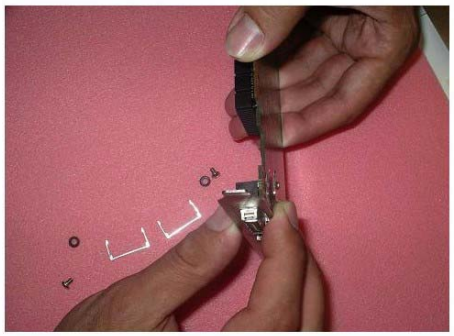
> At the same time extract the bracket as shown in image 18.

(Make sure to protect the LED while extracting the bracket).

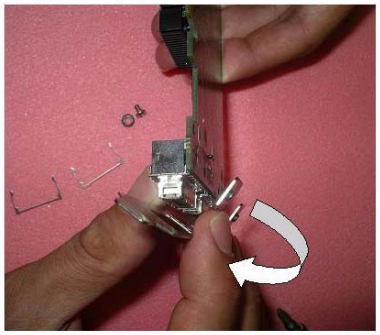
Figure 14: Detach the Bracket in a Rotating Move



(a) Card without Clips and Screws



(b) Grip the Card in Prep. for Detachment

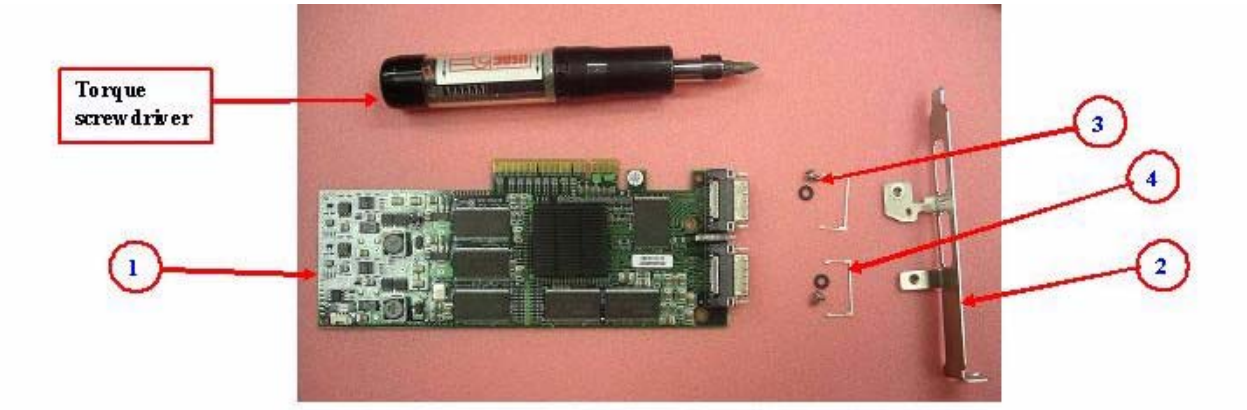


(c) Detach the Bracket in Rotating Move toward Component Side

C.2 Assembling Short Bracket

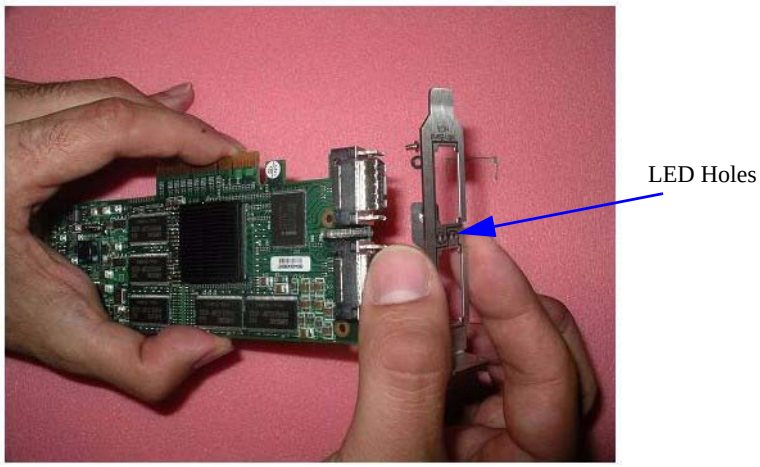
The short bracket can now be assembled onto the HCA card. See Figure 15.

Figure 15: HCA Card Ready for Short Bracket



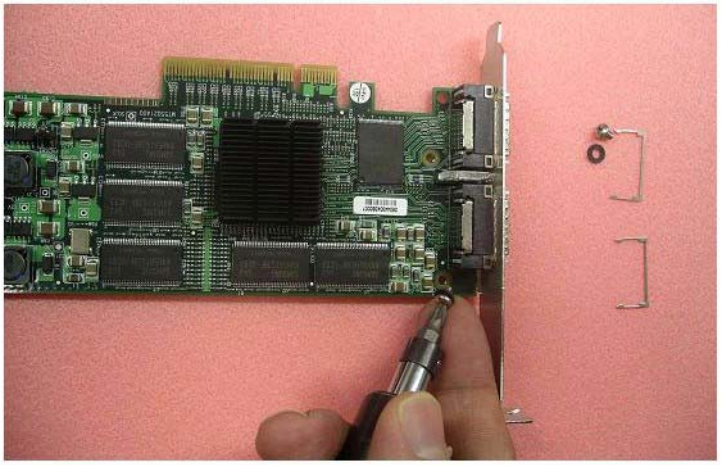
Step 1 - Place short bracket onto card. Gently place the bracket onto the card fitting the connectors through the bracket connector holes. Make sure the LEDs are aligned into their intended bracket holes.

Figure 16: Place Tall Bracket onto Card



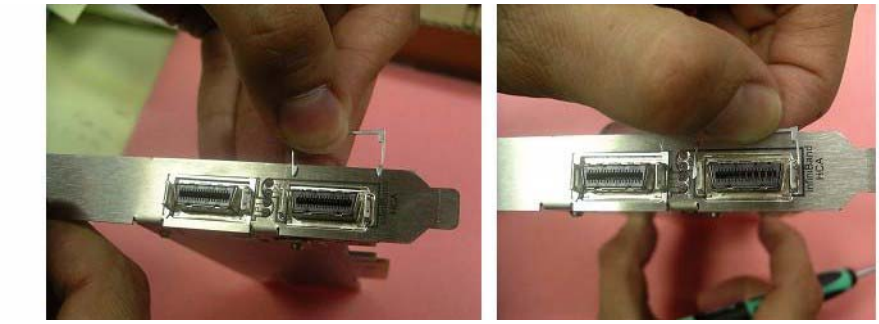
Step 2 - Attach short bracket to card. Insert a screw along with a washer into each of the two holes on the card intended for holding the bracket. Use a torque screwdriver to apply up to 2 lbs-in torque on each screw.

Figure 17: Attach Bracket onto Card using Screws



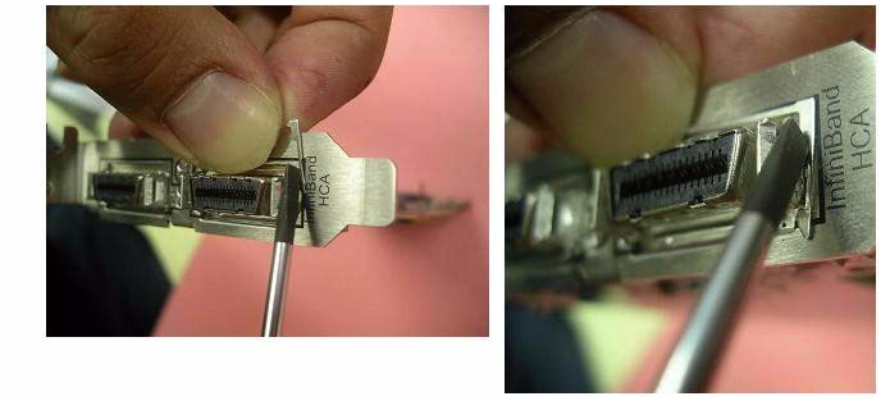
Step 3 - Install Connector Clips. Gently push one clip onto the connector. Make sure to slide both clip hooks (sides) around the connector evenly as shown in Figure 18.

Figure 18: Sliding Connector Clip Evenly



Use a small flat head screwdriver to gently slide the clip's hook towards the connector's base side as shown in Figure 19.

Figure 19: Fix Clip Hooks into Place Using Screwdriver



Repeat this step for the second clip. See Figure 20,"Assembled Short Bracket View".

Figure 20: Assembled Short Bracket View

Appendix D: Avertissements de sécurité d'installation

1. **Instructions d'installation**

Lisez toutes les instructions d'installation avant de brancher le matériel à la source d'alimentation électrique.

2. **Température excessive**

Ce matériel ne doit pas fonctionner dans une zone avec une température ambiante dépassant le maximum recommandé de 55°C (131°F). En outre, pour garantir un bon écoulement de l'air, laissez au moins 8 cm (3 pouces) d'espace libre autour des ouvertures de ventilation.

3. **Empilage du châssis**

Le châssis ne doit pas être empilé sur un autre matériel. Si le châssis tombe, il peut provoquer des blessures corporelles et des dégradations de biens.

4. **Connection d'Alimentation electrique excedentaire -dangers électriques**

Ce produit comporte un "couvercle" qui recouvre l'emplacement de l'alimentation electrique excedentaire. Ne pas faire fonctionner le produit si le "couvercle" n'est pas securise ou si il a ete retire.

5. **Orages – dangers électriques**

Pendant un orage, il ne faut pas utiliser le matériel et il ne faut pas brancher ou débrancher les câbles.

6. **Branchement/débranchement des câbles InfiniBand en cuivre**

Les câbles InfiniBand en cuivre sont lourds et ne sont pas flexibles, il faut donc faire très attention en les branchant et en les débranchant des connecteurs. Consultez le fabricant des câbles pour connaître les mises en garde et les instructions spéciales.

7. **Montage et entretien sur baie**

Lorsque ce produit est monté ou entretenu sur baie, il faut prendre des précautions spéciales pour s'assurer que le système reste stable. En général, il faut remplir la baie avec du matériel de bas en haut.

8. Installation du matériel

Ce matériel ne doit être installé, remplacé ou entretenu que par du personnel formé et qualifié.

9. Elimination du matériel

L'élimination de ce matériel doit s'effectuer dans le respect de toutes les législations et réglementations nationales en vigueur.

10. Codes électriques locaux et nationaux

Ce matériel doit être installé dans le respect des codes électriques locaux et nationaux.